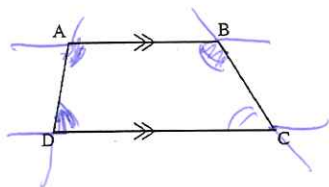


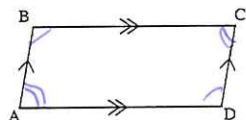
Special Quadrilaterals

Trapezium

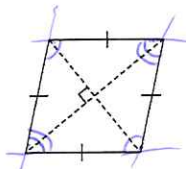
- A trapezium has two parallel sides.
- The sum of the interior angles at the ends of each non-parallel side is 180° . That is,
 $\angle A + \angle D = 180^\circ$ and $\angle B + \angle C = 180^\circ$

**Parallelogram**

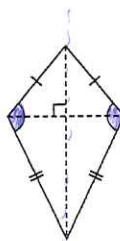
- A parallelogram has opposite sides parallel.
- Its opposite sides are equal.
- Its diagonals bisect each other.
- Its opposite angles are equal. That is,
 $\angle A = \angle C$ and $\angle B = \angle D$

**Rhombus**

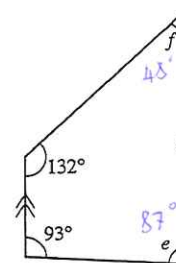
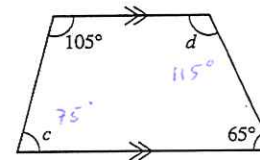
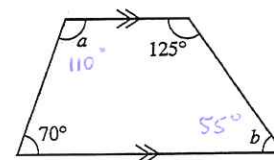
- A rhombus is a parallelogram with all its sides equal.
- Its diagonals bisect each other at right angles.
- Its diagonals also bisect the angles at the vertices.

**Kite**

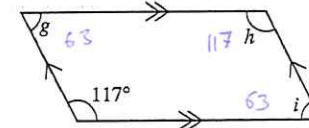
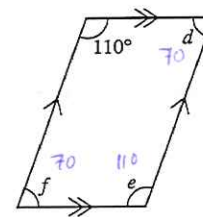
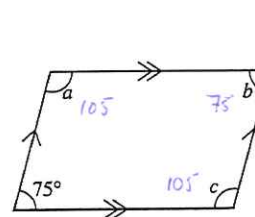
- A kite is a quadrilateral with two pairs of equal adjacent sides.
- Its longer diagonal bisects its shorter diagonal at right angles.
- The opposite angles between the sides of different lengths are equal.

**Exercise 5B**

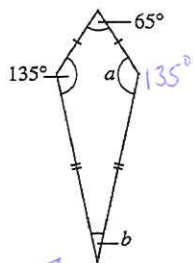
- 1 For each of these trapeziums, calculate the value of the lettered angles.



- 2 For each of these parallelograms, calculate the value of the lettered angles.

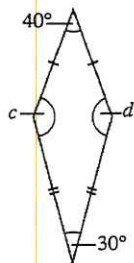


3 For each of these kites, calculate the value of the lettered angles.



$$b = 360 - (2 \times 135 + 65)$$

$$\underline{\underline{b = 25^\circ}}$$



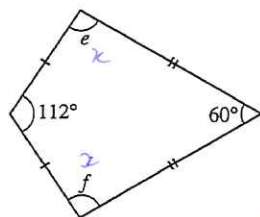
$$c + d = 360 - (30 + 40)$$

$$c + d = 290$$

$$2c = 290$$

$$\underline{\underline{c = 145}}$$

$$\underline{\underline{d = 145}}$$

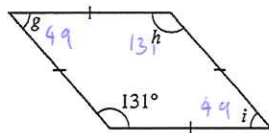
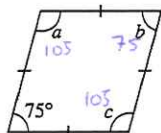


$$2e = 360 - (112 + 60)$$

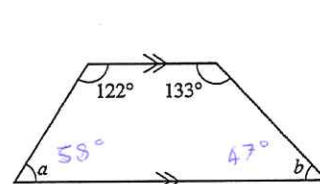
$$2e = 188$$

$$\underline{\underline{e = 94^\circ}}$$

4 For each of these rhombuses, calculate the value of the lettered angles.

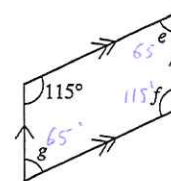
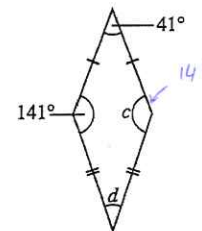


5 For each of these shapes, calculate the value of the lettered angles.

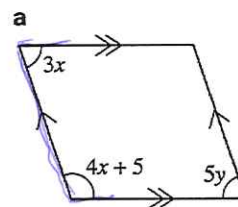


$$d = 360 - (2 \times 141 + 41)$$

$$\underline{\underline{d = 37^\circ}}$$



6 Calculate the values of x and y in each of these parallelograms.



$$3x + 4x + 5 = 180$$

$$7x = 175$$

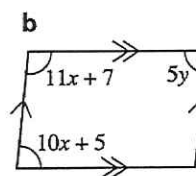
$$\underline{\underline{x = 25^\circ}}$$

$$4x + 5 + 5y = 180$$

$$100 + 5 + 5y = 180$$

$$5y = 75$$

$$\underline{\underline{y = 15^\circ}}$$



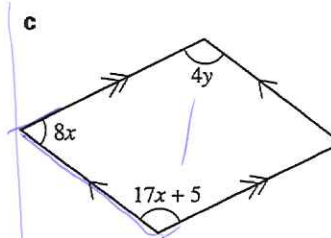
$$2(11x + 7) = 180$$

$$\underline{\underline{x = 8^\circ}}$$

$$5y = 10x + 5$$

$$5y = 85$$

$$\underline{\underline{y = 17^\circ}}$$



$$2(8x + 5) = 180$$

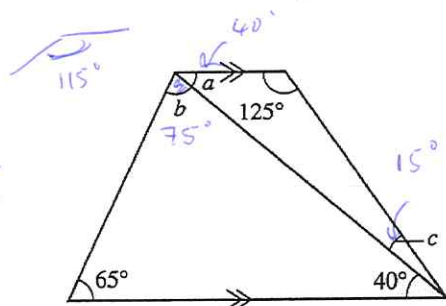
$$\underline{\underline{x = 7^\circ}}$$

$$17x + 5 = 4y$$

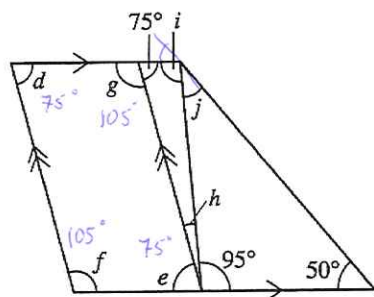
$$124 = 4y$$

$$\underline{\underline{31^\circ = y}}$$

7 For each of these shapes, calculate the value of the lettered angles.

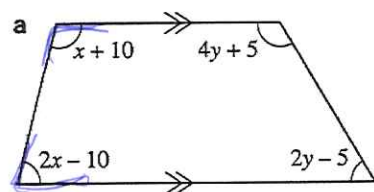


$$\begin{aligned} a &= 40^\circ \\ b &= 75^\circ \\ c &= 15^\circ \end{aligned}$$

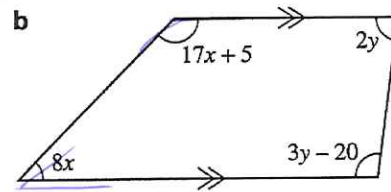


$$\begin{aligned} h &= 180 - 95 - 75 \\ &= 10^\circ \\ i &= 180 - 75 - 10 = 95^\circ \\ j &= 180 - 95 - 50 = 35^\circ \end{aligned}$$

8 Calculate the values of x and y in each of these trapeziums.

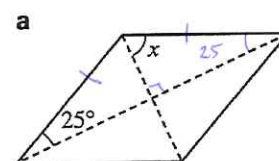


$$\begin{aligned} 3x &= 180 \\ x &= 60^\circ \\ 6y &= 180 \\ y &= 30^\circ \end{aligned}$$

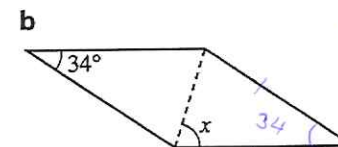


$$\begin{aligned} 25x + 5 &= 180 \\ x &= 7^\circ \\ 5y - 20 &= 180 \\ 5y &= 200 \\ y &= 40^\circ \end{aligned}$$

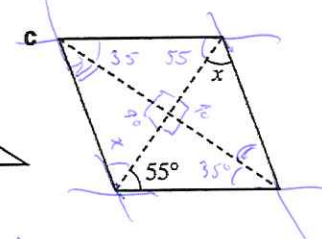
9 Calculate the value of x in each of these rhombuses.



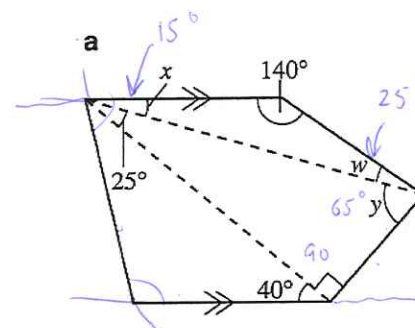
$$x = 65$$



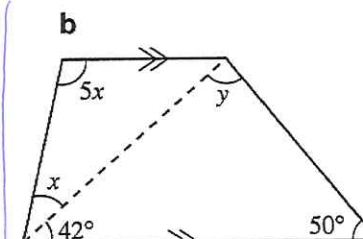
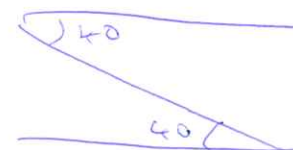
$$\frac{180 - 34}{2} = 73^\circ$$



10 Calculate the values of the letters in each of these shapes.



$$\begin{aligned} y &= 180 - (90 + 25) \\ &= 65^\circ \end{aligned}$$



$$\begin{aligned} 6x + 42 &= 180 \\ x &= 23^\circ \\ y &= 180 - (50 + 42) \\ y &= 88^\circ \end{aligned}$$

Extension

11 Find the value of x in each of these quadrilaterals and hence state the type of quadrilateral it is.

- a One with angles $x + 10$, $x + 20$, $2x + 20$, $2x + 10$
 b One with angles $x - 10$, $2x + 10$, $x - 10$, $2x + 10$
 c One with angles $x - 10$, $2x$, $5x - 10$, $5x - 10$
 d One with angles $4x + 10$, $5x - 10$, $3x + 30$, $2x + 50$

a.) $6x + 60 = 360$
 $x = 50^\circ$

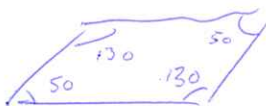
$60^\circ, 70^\circ$
 $120^\circ, 110^\circ$



TRAPEZIUM

b.) $6x = 360$
 $x = 60^\circ$

$50, 130$
 $50, 130$

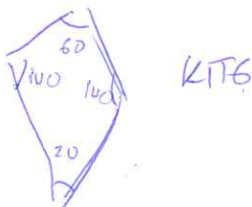


PARALLELOGRAM or RHOMBUS

c.) $13x - 30 = 360$

$x = 30^\circ$

$20^\circ, 60^\circ, 140^\circ, 140^\circ$



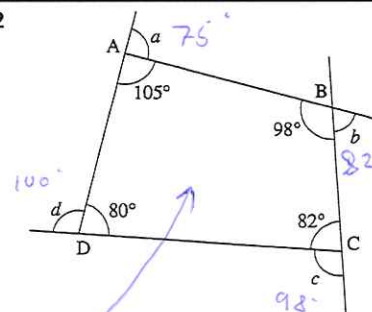
KITE

d.) $14x + 80 = 360$
 $x = 20^\circ$

$90^\circ, 90^\circ, 90^\circ, 90^\circ$

SQUARE or
RECTANGLE

PROOF 12



- a The quadrilateral ABCD has interior angles 100° , 98° , 82° and 80° . Calculate the exterior angles (marked a , b , c , d) for each of the interior angles.

What is the sum of the angles a , b , c , d ?

- b Prove that the sum of the exterior angles of any quadrilateral is 360° .

$a + b + c + d = 355^\circ$

NOT POSSIBLE QUADRILATERAL